



# OSWER Innovations Pilot

## ***Reducing Production Costs and Nitrogen Oxide (NO<sub>x</sub>) Emissions from Biodiesel***

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*The Office of Solid Waste and Emergency Response (OSWER) initiated a series of innovative pilots to test new ideas and strategies for environmental and public health protection. A small amount of money is set aside to fund creative proposals. The creative projects test approaches to waste minimization, energy recovery, recycling, land revitalization, and homeland security that may be replicated across various sectors, industries, communities, and regions. We hope these pilots will pave the way for programmatic and policy recommendations by demonstrating the environmental and economic benefits of creative, innovative approaches to the difficult environmental challenges we face today.*

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### **BACKGROUND**

Biodiesel is a renewable fuel source that is non-toxic, biodegradable, and reduces exhaust emissions of carbon monoxide, unburned hydrocarbons, particulate matter, and sulfur dioxide. Its use can improve air quality, create jobs, and help reduce dependency on limited energy resources and imports. Conventional biodiesel production units, however, are fixed plants operating in a batch mode that require high capital and operation costs. As proposed by many researchers, biodiesel production costs can be reduced by using low-cost raw materials such as waste cooking oil. Restaurants and hotels in the United States produce over 3 billion gallons of waste cooking oil annually, the majority of which is disposed of in sewers and landfills. Studies, however, have shown an increase in nitrogen oxide (NO<sub>x</sub>) emissions, a pollutant that causes smog and ozone, for the biodiesel produced from virgin cooking oil.

### **PILOT APPROACH**

The University of Nevada at Reno (UNR), in collaboration with the Washoe County District Health Department, Applied Research Initiative, Nevada State Department of Agriculture, and U.S. EPA Region 9, will seek to reduce NO<sub>x</sub> emissions and the cost of biodiesel production. This pilot investigates modifying

the biodiesel preproduction process to remove nitrogen compounds before they get into the process stream. Building upon a successful prototype, UNR will build a large-scale mobile continuous process pilot unit using ethanol, instead of methanol, for the production of biodiesel at its campus location.

The biodiesel production process will consist of waste cooking oil pretreatment, reaction, separation, and purification. The NO<sub>x</sub> emission issue will be addressed in the preproduction stage since the raw material of biodiesel has an effect on NO<sub>x</sub> emission. Several feed stocks (virgin and waste cooking oils) will be analyzed for the presence of nitrogen, and a methodology will be developed to remove nitrogen-based compounds before they enter the process stream. The computerized process control system will allow for remote monitoring and adjustments. If successful, the pilot will demonstrate that the biodiesel production unit is viable, reaction-efficient, time-efficient, and cost effective.

### **INNOVATION**

This pilot will remove the cost disincentive from the use of biodiesel and tackle the key issue of NO<sub>x</sub>. Instead of focusing on post production solutions to reduce NO<sub>x</sub> emission, this pilot will focus on preproduction solutions. Moreover, manufactured methanol will be replaced with renewable ethanol. Using ethanol will provide a safer work environment for personnel (less

volatile, less toxic, less corrosive, and cleaner). Costs will be reduced by introducing a continuous production process using automation and process control. Using local agricultural resources and waste cooking oil will have a direct impact on lowering feed costs. The unit will be mobile, which will allow transport of the processing capabilities to rural areas that need the service.

## **BENEFITS**

In the short term, all of UNR's diesel needs will be met by using the biodiesel produced with the mobile continuous process pilot unit. The large-scale pilot unit will adhere to a zero waste stream policy goal. In the long term, the outcome of this pilot project will tremendously help the agricultural industry by providing them with a large energy market and will provide sufficient incentive for farmers to cultivate additional crops. Air quality will be enhanced by the widespread use of biodiesel. Also, waste minimization will be achieved by recycling waste cooking oil.

## **CONTACTS**

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For additional information, visit the EPA OSWER Innovations web site at: [www.epa.gov/oswer/iwg](http://www.epa.gov/oswer/iwg).